PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-118701**

(43)Date of publication of application : **30.04.1999**

(51)Int.Cl. G01N 15/06
G01N 1/00
G01N 1/22
G21C 17/00
// G01W 1/00

(21)Application number : **09-276862**

(22)Date of filing : **09.10.1997**

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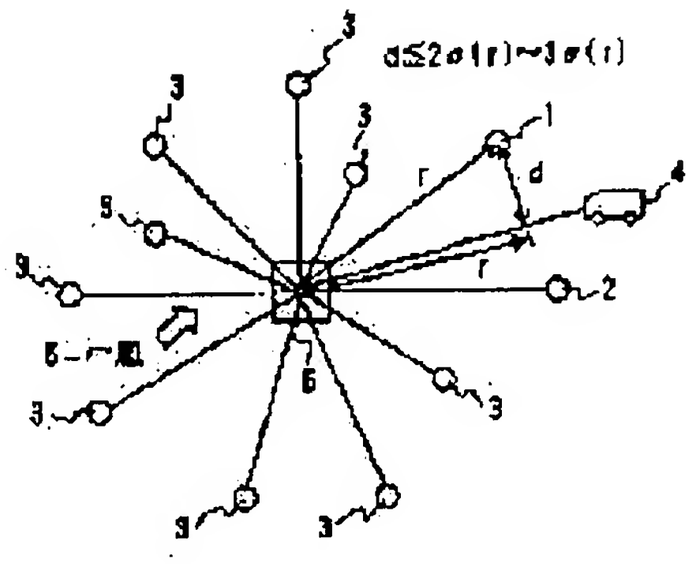
(54) ENVIRONMENT-MONITORING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent a state where a substance emitted into an environment passing through detecting means, by arranging the detecting means with taking into account a diffusion extent of the substance emitted in the environment determined by a meteorological condition.

SOLUTION: Fixed detecting means 1, 2, 3 for measuring meteorological data such as a concentration of a substance feared to be diffused in an environment from an emission point 5, a wind direction, a wind velocity, etc., are arranged in the periphery of the emission point 5. A movement-detecting means 4 is placed on the lee of the emission point 5 because the emitted substance is diffused between the detecting means 1 and 2 due to a wind direction 6 at the time. A distance between the detecting means, and an angle of lines connecting the emission point 5 and detecting means are set properly while a diffusion width of the substance emitted in the environment determined from meteorological conditions is taken into account. Accordingly at least one or two detecting means catches the diffusion of the emitted substance at all times under almost any meteorological conditions, thus enabling measurement of a concentration. The emitted substance never slips through between the



detecting means.

LEGAL STATUS

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[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

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CLAIMS

[Claim(s)]
[Claim 1] In the environmental supervisory equipment which has arranged in an environment a detection means to detect the concentration of the matter emitted into the environment When setting standard deviation of the diffusion width of face of released goods [in / for the distance from an emitting point to the 1st detection means / r (m) and distance r] to sigma (r) and (m), Environmental supervisory equipment characterized by making into less than 2sigma (r) or less than 3sigma (r) the point on the straight line which adjoins the straight line which said emitting point and the 1st detection means make among the points of the distance r from the emitting point on the straight line which connects said emitting point and other detection means, and distance between said 1st detection means. Here, the range of sigma (r) is given by the degree type.
0. 05R0.8 <=Sigma(R) <=0.3R0.92 -- [Claim 2] In the environmental supervisory equipment which has arranged in an environment a detection means to detect the concentration of the matter emitted into the environment When setting standard deviation of the diffusion width of face of released goods [in / for the distance from an emitting point to the 1st detection means / r (m) and distance r] to sigma (r) and (m), When setting to theta the include angle which the straight line which connects the straight line and the emitting point which adjoin said 1st detection means among the straight lines which connect said emitting point and other detection means, and said 1st detection means makes, Environmental supervisory equipment characterized by an include angle theta being less than 2sin(s)-1 {sigma(r)/r} or less than 2sin(s)-1 {3sigma(r) / 2r}. Here, the range of sigma (r) is given by the degree type.
0. 05R0.8 <=Sigma(R) <=0.3R0.92 -- [Claim 3] In the environmental supervisory equipment which has arranged in an environment a detection means to detect the concentration of the matter emitted into the environment When setting standard deviation of the diffusion width of face of released goods [in / for the distance from an emitting point to the 1st detection means / r (m) and distance r] to sigma (r) and (m), Environmental supervisory equipment characterized by making into less than 4sigma (r) or less than 6sigma (r) the point on the straight line which adjoins the straight line which said emitting point and the 1st detection means make among the points of the distance r from the emitting point on the straight line which connects said emitting point and other detection means, and distance between said 1st detection means. Here, the range of sigma (r) is given by the degree type.
0. 05R0.8 <=Sigma(R) <=0.3R0.92 -- [Claim 4] In the environmental supervisory equipment which has arranged in an environment a detection means to detect the concentration of the matter emitted into the environment When setting standard deviation of the diffusion width of face of released goods [in / for the distance from an emitting point to the 1st detection means / r (m) and distance r] to sigma (r) and (m), When considering as the include angle theta which the straight line which connects the straight line and the emitting point which adjoin said 1st detection means among the straight lines which connect said emitting point and other detection means, and said 1st detection means makes, Environmental supervisory equipment characterized by an include angle theta being less than 2sin(s)-1 {2sigma(r)/r} or less than 2sin(s)-1 {3sigma(r)/r}. Here, the range of sigma (r) is given by the degree type.
0. 05R0.8 <=Sigma(R) <=0.3R0.92 -- [Claim 5] Environmental supervisory equipment characterized by

fixing in an environment the location where said detection means is arranged in any 1 term of claims 1, 2, 3, and 4.
[Claim 6] Environmental supervisory equipment characterized by fixed detection means by which said detection means was fixed in the environment in the location, and constituting the inside of an environment from a movable migration detection means in any 1 term of claims 1, 2, 3, and 4.
[Claim 7] Environmental supervisory equipment characterized by to direct and display the diffusion range and the migration location of the matter which predicted the diffusion range of the matter emitted into the environment by the weather prediction means, the diffusion prediction means or the meteorological observation means, and the diffusion prediction means, and were emitted to the migration detection means.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to suitable environmental supervisory equipment to use for an environment in works and the plant which deal with the matter with a possibility of affecting it, when it is emitted into an environment with respect to environmental supervisory equipment in emergency, such as a chemical plant, and an atomic power plant, a reprocessing facility.
[0002]
[Description of the Prior Art] In order to measure the environmental concentration of the matter generally emitted to the environment into the environment from the works treating an atmospheric pollutant with a possibility of affecting it, or a plant, a detection means to measure the concentration of the released goods called a monitoring post and a monitoring station, wind direction, and a wind speed is installed into an environment as environmental supervisory equipment. If the matter applied to an environment should be emitted, it is necessary to grasp a diffusion situation and concentration, to evaluate the effect on an environment based on the data obtained from these detection means, and to take suitable correspondence in emergency.
[0003] For this reason, such a detection means must be arranged appropriately in an environment. Said detection means arranged around works or a plant as conventionally shown in drawing 3 is arranged at intervals of about one point in the four to 16 bearing focusing on the emitting point assumed. And the diffusion situation has been grasped from distribution of the concentration detected by these detection means, and it had become equipment by which the effect on an environment is evaluated. JP,2-64437,A can be mentioned as this kind of a technique.
[0004]
[Problem(s) to be Solved by the Invention] Generally, the diffusion situation of the matter emitted into the environment can be predicted by the diagram of Pasquill-Gifford which summarized experimentally the standard deviation of the diffusion width of face of a diffusate in the distance from an emitting point to every [which receives in drawing 5 horizontally and shows an example] atmospheric stability (A-F).
[0005]
[Table 1]

表　1

Pasquillの安定度分類						
地上風速 m／s	日　中			日中と夜間	夜　間	
	日射量cal／cm² hr			本　曇 (8～10)	上曇(5～10) 中・下層雲量 (5～7) 0～5	曇　晴 (0～5)
	強 >50	並 49～25	弱 <24			
<2	A	A～B	B	D	−	−
2～3	A～B	B	C	D	E	F
3～4	B	B～C	C	D	D	E
4～6	C	C～D	D	D	D	D
>6	C	C	D	D	D	D

A：強不安定，B：並不安定，C：弱不安定，D：中立，E：弱安定、F：並安定

[0006] The atmospheric stability which is needed in case it asks for diffusion width of face from this diagram is defined according to the stability classification of Pasquill of Table 1 from meteorological conditions, such as a wind speed, and intensity of radiation, an amount of cloud. The matter which rides on a wind from an emitting point and is diffused into an environment spreads in an environment, as typically shown in drawing 6 , and the standard deviation of the flare width of face of the diffusate is said Pasquill-Gifford. It is evaluated from a diagram. Concentration distribution of the matter emitted into the environment follows normal distribution as shown in drawing 7 .

[0007] If standard deviation of the diffusion width of face in distance [from an emitting point] r (m) is set to sigma (r) and (m), in **2sigma (r) and about 99% section, about 95% section of the flare of the diffusate in distance r exists in the range of **3sigma (r). Drawing 8 considers the section about 95% generally used in the field of statistical, and compares the distance between the detection means at the time of having arranged the detection means on the periphery of a radius r in the width of face of **2sigma corresponding to each atmospheric stability (r), i.e., 4sigma, (r), and the 16 bearing. When atmospheric stability is A-B, it is more possible than drawing 8 to catch the flare of the matter emitted into the environment with the detection means arranged to 16 bearing extent.

[0008] However, when atmospheric stability is C-F, it is suggested that the case where it becomes difficult to catch the flare of the emitted matter and concentration in an environment cannot be measured may happen. That is, when the detection means is not appropriately arranged in environmental supervisory equipment, if all meteorological conditions are taken into consideration, we will be anxious about that the situation of passing through between a detection means by which the matter emitted into the environment has been arranged into an environment, and detection means may occur.

[0009]

[Means for Solving the Problem] In order to solve such a technical problem, he is trying to arrange a detection means into an environment in the environmental supervisory equipment of this invention in consideration of the diffusion width of face of the matter emitted into the environment given from the atmospheric stability which becomes settled from the aforementioned meteorological condition.

[0010] Namely, when setting standard deviation of the diffusion width of face of released goods [in / for the distance from an emitting point to the 1st detection means / r (m) and distance r] to sigma (r) and (m), A detection means is arranged so that it may become less than 2sigma (r) or less than 3sigma (r) about the point on the straight line which adjoins the straight line which said emitting point and the 1st detection means make among the points of the distance r from the emitting point on the straight line which connects said emitting point and other detection means, and the distance between said 1st detection means. Here, the range of sigma (r) is given by the degree type.

[0011]

[Equation 1] 0. The inequality of the 05r0.8 <=sigma(r) <=0.3r0.92 above is a correlation coefficient 0.98 by the least square method to atmospheric stability A-F about the diagram of Pasquill-Gifford

shown in drawing 5 . It approximates above by the formula of a exponentiation mold.
[0012] Moreover, when said technical problem sets to theta the include angle which the straight line which connects the straight line and the emitting point which adjoin said 1st detection means among the straight lines which connect an emitting point and other detection means, and said 1st detection means makes, It is solved also by arranging a detection means so that an include angle theta may become less than 2sin(s)-1 {sigma(r)/r} or less than 2sin(s)-1 {3sigma(r) / 2r}.
[0013] Furthermore, it is solved also by arranging a detection means so that it may become less than 4sigma (r) or less than 6sigma (r) about the point on the straight line which adjoins the straight line which said emitting point and the 1st detection means make among the points of the distance r from the emitting point on the straight line which connects an emitting point and other detection means, and the distance between said 1st detection means. Moreover, when considering as the include angle theta which the straight line which connects the straight line and the emitting point which adjoin said 1st detection means among the straight lines which connect an emitting point and other detection means, and said 1st detection means makes, it is also the same as when arranging a detection means so that an include angle theta may become less than 2sin(s)-1 {2sigma(r)/r} or less than 2sin(s)-1 {3sigma(r)/r}.
[0014] Moreover, the detection means arranged in the aforementioned environment makes it possible the fixed detection means fixed in the environment in the location, and to constitute the inside of an environment combining a movable migration detection means. When combining a migration detection means, the diffusion range of the matter emitted into the environment by the weather prediction means, the diffusion prediction means or the meteorological observation means, and the diffusion prediction means predicts, the diffusion range and the migration location of the matter which were emitted to a migration detection means direct and display, it moves to the location a migration detection means is suitable in a location, and concentration is making measure.
[0015]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained using a drawing.
[0016] The example 1 of arrangement of the detection means in the environmental supervisory equipment of this invention is shown in drawing 1 . Fixed detection means 1, 2, and 3 to measure meteorological datas, such as concentration of the matter which has a possibility that it may be spread into an environment from an emitting point in the surroundings of the emitting point 5, and wind direction, a wind speed, are arranged. In this example, since the emitted matter diffuses between the fixed detection means 1 and 2 from the wind direction 6 at that time, the migration detection means 4 is arranged to the lee side of an emitting point.
[0017] In this case, it is carrying out to less than 2sigma (r) from standard deviation [of diffusion width of face] sigma (r) asked for the point of the distance r from the emitting point on the straight line which connects an emitting point and the migration detection means 4, said fixed detection means 1, or the distance d between two from (several 1), or less than 3sigma (r). By making the aforementioned distance d less than into 2sigma (r), the detection means of at least two points is arranged within the section of about 95% of the flare of released goods, and it is measurable in the concentration of released goods. Moreover, if the aforementioned distance d is made less than into 3sigma (r), the detection means of at least two points will be arranged within the section of about 99% of the flare of released goods. the migration detection means 4 -- concentration and wind direction -- the orbital vehicle which runs the automobile [carrying detection devices, such as - wind speed,] and orbit top set up beforehand is applicable.
[0018] Next, the example 2 of arrangement of the detection means in the environmental supervisory equipment of this invention is shown in drawing 2 . Fixed detection means 1, 2, and 3 to measure meteorological datas, such as concentration of the matter which has a possibility that it may be spread into an environment from the emitting point 5 in the surroundings of the emitting point 5, and wind direction, a wind speed, are arranged, and the migration detection means 4 is arranged in the lee side of the emitting point 5. In this case, when setting to theta the include angle which the straight line which connects the straight line and the emitting point of connecting the emitting point 5 and the fixed

detection means 1 or 2, and the migration detection means 4 makes, it arranges so that an include angle theta may become less than 2sin(s)-1 {sigma(r)/r} or less than 2sin(s)-1 {3sigma(r) / 2r}. By making the aforementioned include angle theta less than into 2sin(s)-1 {sigma(r)/r}, the detection means of at least two points is arranged within the section of about 95% of the flare of released goods. Moreover, if the aforementioned include angle theta is carried out within 2sin(s)-1 {3sigma(r) / 2r}, it is possible for the detection means of at least two points to be arranged within the section of about 99% of the flare of released goods, and to catch released goods.

[0019] The example 3 of arrangement of the detection means in the environmental supervisory equipment of this invention is shown in drawing 9 . Fixed detection means 1, 2, and 3 to measure meteorological datas, such as concentration of the matter which has a possibility that it may be spread into an environment from an emitting point in the surroundings of the emitting point 5, and wind direction, a wind speed, were allotted, and the migration detection means 4 is arranged to the lee side of an emitting point. In this case, the point of the distance r from the emitting point on the straight line which connects an emitting point and the migration detection means 4, said fixed detection means 1, or distance d between two is made into less than 4sigma (r) or less than 6sigma (r). By making the aforementioned distance d less than into 4sigma (r), the detection means of at least one point is arranged within the section of about 95% of the flare of released goods, and it is measurable in the concentration of released goods. Moreover, if the aforementioned distance d is made less than into 6sigma (r), the detection means of at least one point will be arranged within the section of about 99% of the flare of released goods.

[0020] Next, the example 4 of arrangement of the detection means in the environmental supervisory equipment of this invention is shown in drawing 10 . Fixed detection means 1, 2, and 3 to measure meteorological datas, such as concentration of the matter which has a possibility that it may be spread into an environment from the emitting point 5 in the surroundings of the emitting point 5, and wind direction, a wind speed, are arranged, and the migration detection means 4 is arranged in the lee side of the emitting point 5. In this case, when setting to theta the include angle which the straight line which connects the straight line and the emitting point of connecting the emitting point 5 and the fixed detection means 1 or 2, and the migration detection means 4 makes, it arranges so that an include angle theta may become less than 2sin(s)-1 {2sigma(r)/r} or less than 2sin(s)-1 {3sigma(r)/r}. By making the aforementioned include angle theta less than into 2sin(s)-1 {2sigma(r)/r}, the detection means of at least one point is arranged within the section of about 95% of the flare of released goods. moreover, the aforementioned include angle theta -- 2sin(s)- if it is made 1 {3sigma(r)/r}, it is possible for the detection means of at least one point to be arranged within the section of about 99% of the flare of released goods, and to catch released goods.

[0021] The block diagram of the environmental supervisory equipment of this invention is shown in drawing 11 R> 1. In the environment of the circumference of facilities, i.e., an emitting point, such as works and a plant, the fixed detection means 1, 2, and 3 and the migration detection means 4 are arranged. In this environmental supervisory equipment, the meteorological observation value offered [Meteorological Agency], numerical prediction data, and the data from the meteorological observation means in a facility are collected with meteorological-data collection equipment as a meteorological data. Based on the collected meteorological data, weather analysis equipment searches for distribution of within the limits the circumference of a facility in connection with the weather, such as a wind speed, wind direction (wind-speed vector) and temperature, humidity, and rainfall, and for a monitor.

[0022] A meteorological data and weather analysis data are displayed and outputted if needed. In a facility, a certain abnormalities occur, when anxious about emission of the matter with a possibility of affecting an environment, with diffusion analysis equipment, the emission concentration in an emitting point is standardized to unit concentration, and diffusion analysis is carried out. Analysis data, such as a diffusion situation based on the result and concentration distribution standardized by emitting point concentration, are transmitted to the migration detection means 4 while they are displayed by control / management equipment. The analysis data transmitted to the migration detection means 4 are displayed within the migration detection means 4, and the location suitable for measurement is directed. Based on

this display and directions, the migration detection means 4 moves to diffusion within the limits of released goods, and measures data, such as concentration.
[0023] The measurement result of the fixed detection means 1, 2, and 3 and the migration detection means 4 is transmitted to control / management equipment, and changes into an actual value the concentration distribution standardized by the emitting point concentration calculated with above diffusion analysis equipment based on the data measured in the environment. While evaluation of the concentration distribution in an environment is attained by this, the emission concentration in an emitting point is called for. The diffusion situation and concentration distribution of the matter which were emitted into the environment can be evaluated by this, and the data for taking the suitable measures for emergency are offered.
[0024] above -- the migration detection means 4 -- concentration and wind direction -- the orbital vehicle which runs the automobile [carrying detection devices, such as - wind speed,] and orbit top set up beforehand is applicable. Moreover, these migration detection means are realizable with the uninhabited vehicle controlled by an owner man's vehicle, control / management equipment, etc. Furthermore, a cable and wireless can attain control of the migration detection means 4, and the transmission of the information between control / management equipment and the migration detection means 4.
[0025] Drawing 12 is an example of a display at the time of control / management equipment displaying the analysis result of diffusion analysis equipment on a migration detection means etc. Arrangement of the main terrain intelligences 11, such as high lines, such as main configurations, such as works used as the emitting point 5 and a plant, average wind direction, a wind speed 6, and the fixed detection means 3 is displayed on a screen. Based on the diffusion situation and concentration distribution in analysis data, the flare 8 of emission and a diffusate is displayed and the migration directions location 9 to the migration detection means 4 is shown in the center section of the flare 8 of emission and a diffusate.
[0026] At this example, since the fixed detector 3 does not exist within the limits of the flare 8 of emission and a diffusate, in the form which complements between fixed detectors, the migration detector 4 caught the flare 8 of emission and a diffusate, and has measured concentration. wind direction with the count uniform within an analytical range standardized by the emission concentration in the emitting point in diffusion analysis equipment - wind speed is assumed, and when geographical feature is comparatively flat, it can carry out easily by using the analysis solution based on the following gauss PURYUMU models.
[0027]
[Equation 2]

$$\frac{\chi(x,y,z)}{q} = \frac{1}{2\pi\sigma_y\sigma_z u}\exp\left(-\frac{y^2}{2\sigma_y^2}\right)\left[\exp\left\{-\frac{(z-H)^2}{2\sigma_z^2}\right\} + \exp\left\{-\frac{(z+H)^2}{2\sigma_z^2}\right\}\right]$$

[0028] Here, for spacial concentration and q, the burst size of the diffusate per unit time amount and u are [chi (x y, z)] a wind speed, sigmay, and sigmaz. Level and the horizontal coordinate to which in the standard deviation of the diffusion width of face of the direction of a vertical and H emission height and x [a wind horizontal coordinate and] cross at right angles, and x and y cross at right angles, and z are the direction coordinates of a vertical.
[0029] on the other hand -- the inside of an analytical range -- wind direction - wind speed is not uniform, and when the effect of geographical feature must also be taken into consideration, diffusion analysis is possible by the false particle pursuing method which emits and pursues many false particles shown typically to drawing 13 . The behavior of the false particle by this technique is pursued based on a degree type.

[0030]
[Equation 3] X(t) =X(t)+deltatU -- here, the location of a particle [in / in X (t) / time of day t] and U are the passing speed of a false particle, and time amount unit width of face [in / in deltat / count]. moreover, the amount UD of turbulent flow fluctuation of the average wind speed [in / in U / a particle location] Uw, and a wind speed etc. -- from -- it is the becoming vector quantity and asks according to the result of weather analysis. By this technique, the amount corresponding to the rate of emission of released goods is given to each false particle, and the concentration in atmospheric air is called for by calculating and converting the particle number in the volume which a count grid constitutes. The number of the false particle which emits the burst size of the diffusate per unit time amount to per q and time amount unit width of face is given to n, then spacial concentration chi (x y, z) by the degree type.
[0031]
[Equation 4]

$$\frac{\chi(x,y,z)}{q} = \frac{\frac{\Delta t}{n}N(x,y,z)}{\Delta x \Delta y \Delta z}$$

[0032] Here, the particle number in which N is contained in the cel of a location (x y, z), and deltax, delta y and delta z are the count cell sizes in concentration count.
[0033]
[Effect of the Invention] In the environmental supervisory equipment of this invention, spacing between the fixed detection means in an environment or a migration detection means and the include angle between the straight lines which an emitting point and a detection means make are appropriately set up in consideration of the diffusion width of face of the matter emitted into the environment which becomes settled from a meteorological condition. This catches the flare of the matter with which at least one thru/or two detection means were always emitted into the environment to the bottom of almost all meteorological conditions, and it becomes measurable about concentration. For this reason, concern of passing through between a detection means by which the matter emitted into the environment has been arranged into an environment, and detection means is canceled.
[0034] Furthermore, in the environmental supervisory equipment of this invention, the diffusion range of the matter emitted into the environment by the weather prediction means, the diffusion prediction means or the meteorological observation means, and the diffusion prediction means is predicted, and the diffusion range and migration location of the matter which were emitted to the migration detection means are directed and displayed. Thereby, a migration detection means moves to the suitable location according to the diffusion situation of released goods, and becomes measurable about concentration.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Drawing showing arrangement of the detection means in the environmental supervisory equipment which is the example 1 of this invention.
[Drawing 2] Drawing showing arrangement of the detection means in the environmental supervisory equipment which is the example 2 of this invention.
[Drawing 3] Drawing showing the example of arrangement of the detection means in conventional environmental supervisory equipment.
[Drawing 4] The property Fig. showing the concentration distribution measurement result in arrangement of the detection means in conventional environmental supervisory equipment.
[Drawing 5] The diagram of Pasquill-Gifford (horizontal diffusion width of face).
[Drawing 6] The conceptual diagram of the flare of a diffusate.
[Drawing 7] The property Fig. showing concentration distribution of a diffusate.
[Drawing 8] The property Fig. showing relation with the comparison of the width of face of 95% section and bearing of the flare of a diffusate.
[Drawing 9] Drawing showing arrangement of the detection means in the environmental supervisory equipment which is the example 3 of this invention.
[Drawing 10] Drawing showing arrangement of the detection means in the environmental supervisory equipment which is the example 4 of this invention.
[Drawing 11] The block diagram of environment monitoring by the environmental supervisory equipment of this invention.
[Drawing 12] Drawing showing directions of the diffusion range of the released goods in the environmental supervisory equipment of this invention, and a migration location, and the example of a display.
[Drawing 13] The conceptual diagram of the diffusion prediction by the false particle.
[Description of Notations]
1, 2, 3 [-- Wind direction 7--16 bearing, 8 / -- The flare of emission and a diffusate, 9 / -- The migration directions location to a migration detection means, 10 / -- A false particle 11 / -- Terrain intelligences such as a contour line.] -- A fixed detection means, 4 -- A migration detection means, 5 -- An emitting point, 6

[Translation done.]

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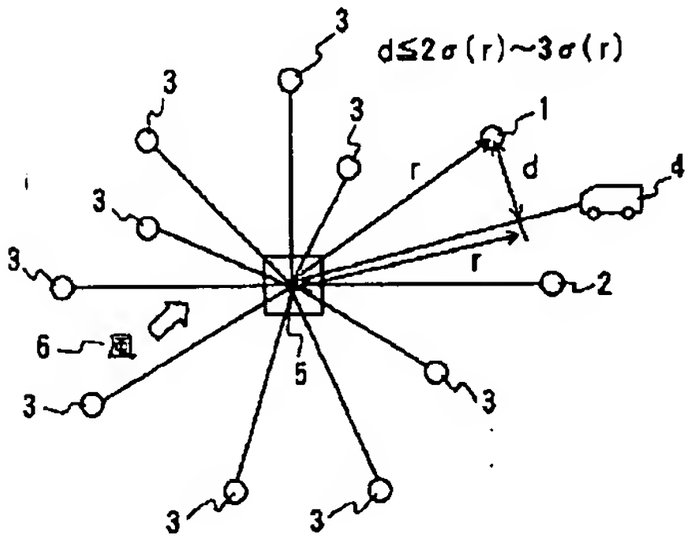
DRAWINGS

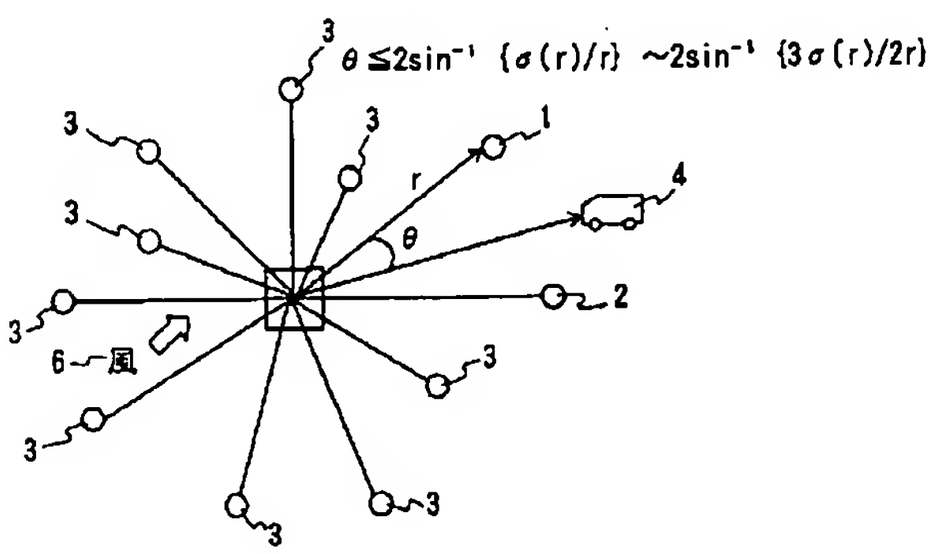
[Drawing 1]

図 1



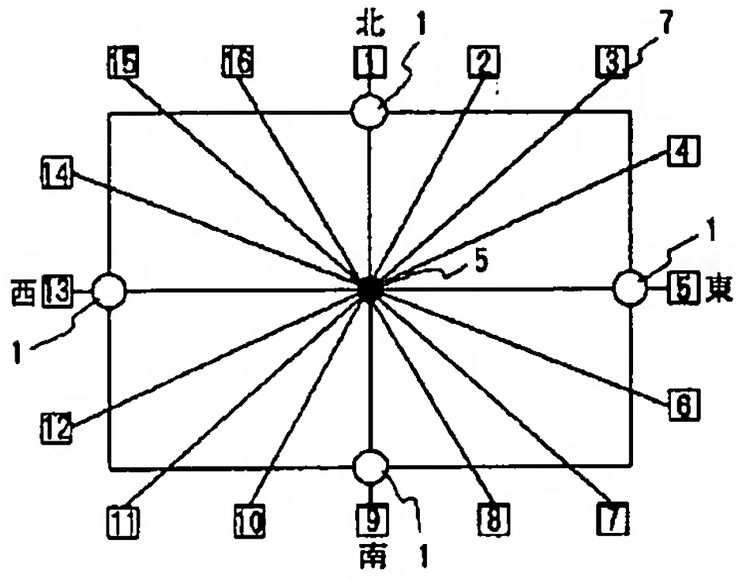
[Drawing 2]

図 2



[Drawing 3]

図 3



[Drawing 4]

図 4

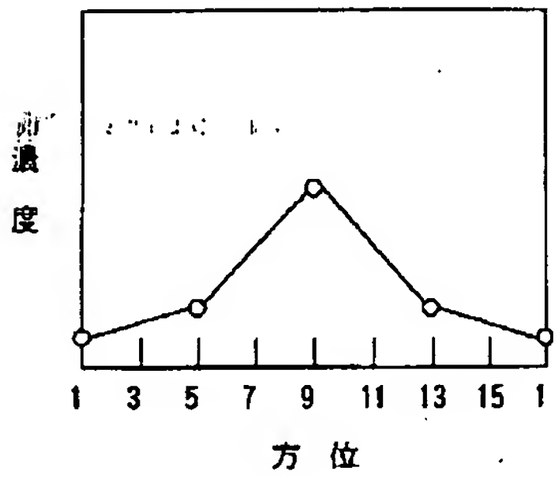


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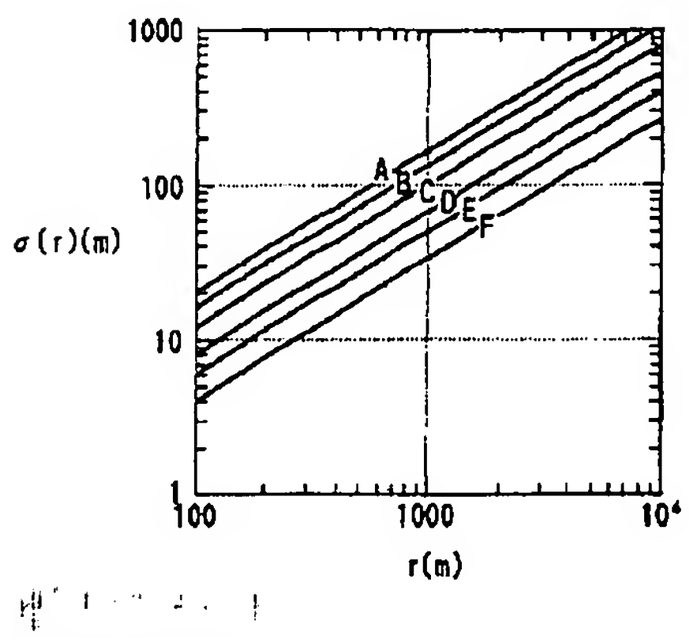
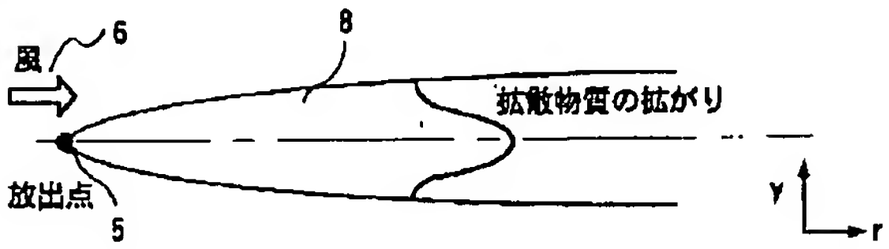
図 5



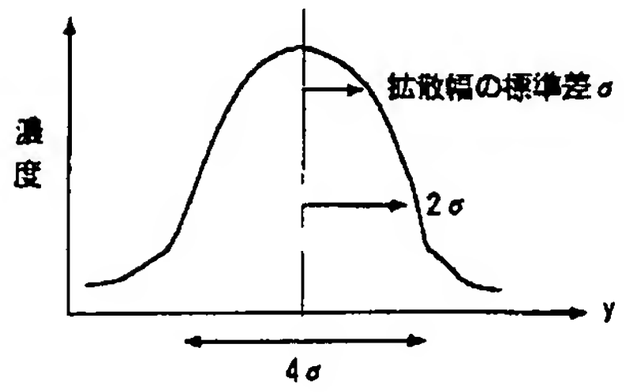
[Drawing 6]

図 6



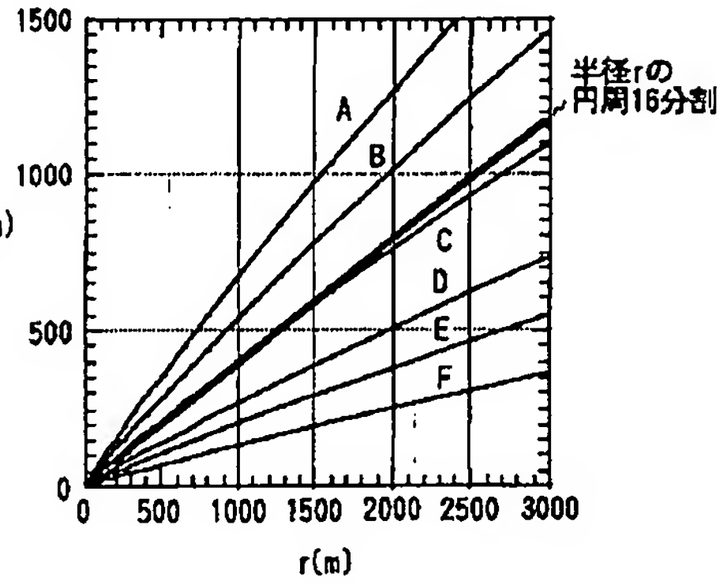
[Drawing 7]

図 7



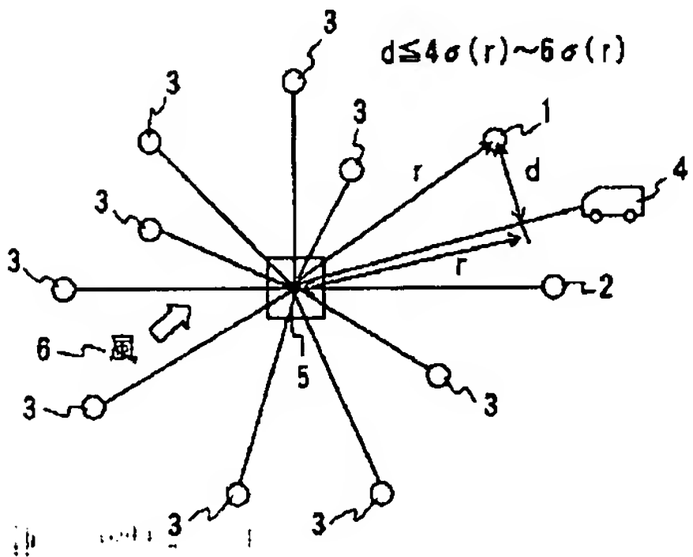
[Drawing 8]

図 8



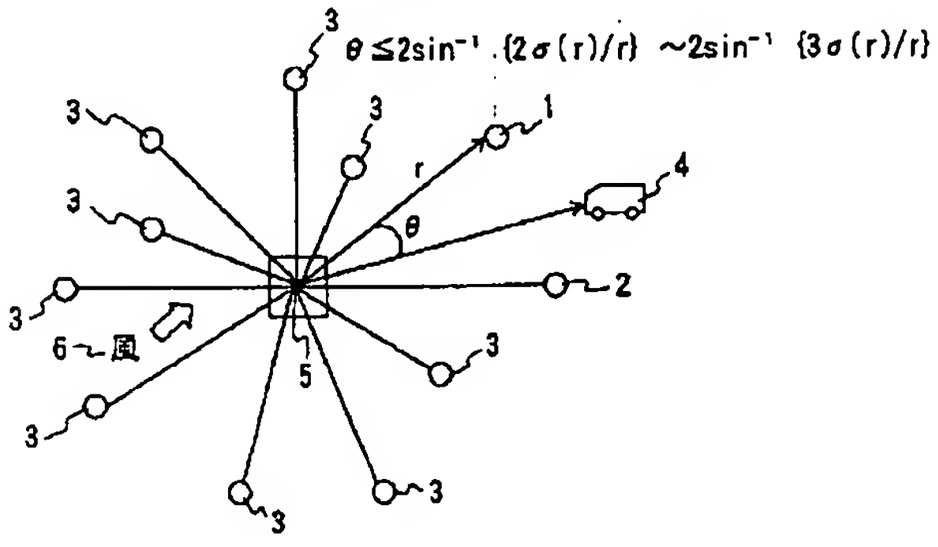
[Drawing 9]

図 9



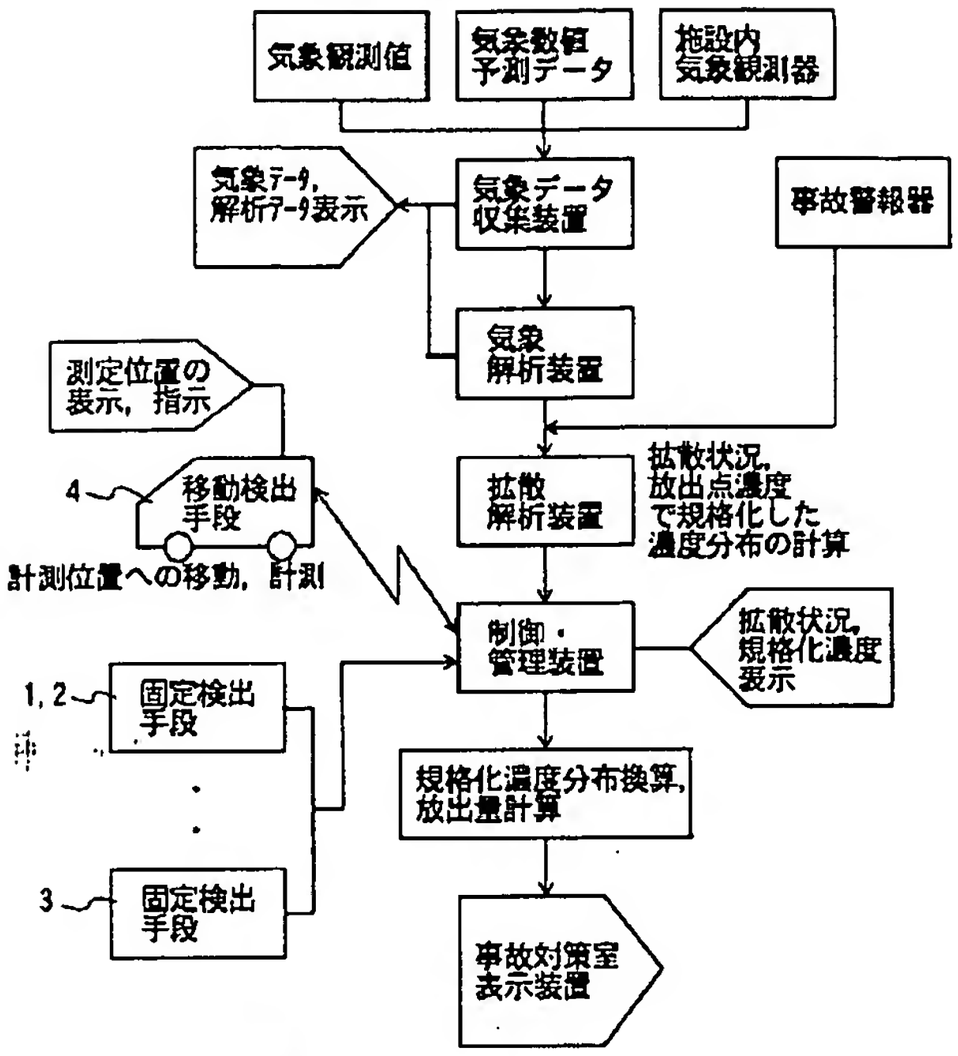
[Drawing 10]

図 10



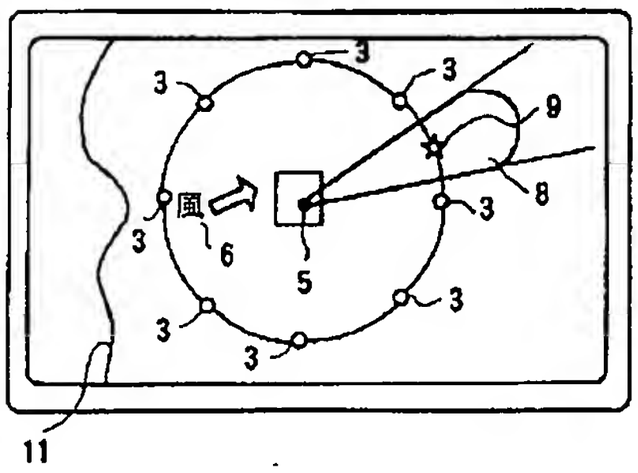
[Drawing 11]

図 11



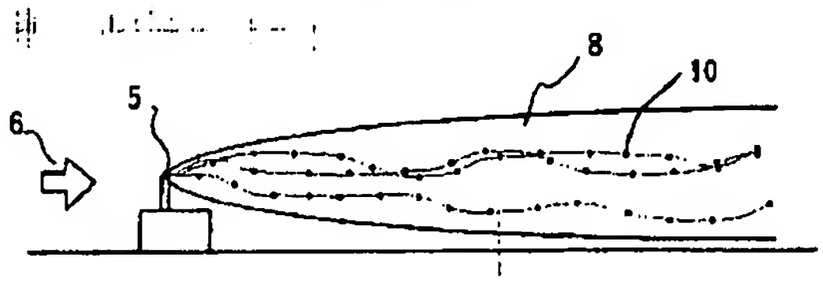
[Drawing 12]

図 12



[Drawing 13]

図 13



[Translation done.]